

WHAT IS CLAIMED IS:

1. A method of generating a monophonic output from a pair of input signals comprising:

combining at least a portion of a first input with at least a portion of a second input to isolate difference information;

enhancing the difference information to produce enhanced difference information; and

combining the enhanced difference information with at least a portion of the first and second inputs to generate an enhanced monophonic output.

2. The method of Claim 1 wherein the act of enhancing the difference information comprises adjusting an amplitude of the difference information.

3. The method of Claim 1 wherein the act of enhancing the difference information comprises adjusting an amplitude and phase of the difference information.

4. The method of Claim 3 wherein adjusting the phase of the difference information modifies a frequency response at frequencies where the frequency responses of an audio enhancement system have approximately equal amplitudes and opposite phases so as to preserve audio information at the frequencies.

5. The method of Claim 1 further comprising reproducing audio from the enhanced monophonic output through a speaker wherein the act of enhancing the difference information is dependent on speaker characteristics of the speaker.

6. The method of Claim 1 wherein the act of enhancing the difference information comprises filtering and adjusting the gain of the difference information.

7. The method of Claim 1 further comprising combining at least a portion of the first input with at least a portion of the second input to isolate sum information and wherein the act of combining to generate an enhanced monophonic output comprises combining the enhanced difference information with the sum information.

8. The method of Claim 7 further comprising filtering the sum information wherein the act of filtering the sum information adjusts the phase of the sum information relative to the difference information.

9. The method of Claim 1 wherein the acts of combining to produce difference information, enhancing to produce enhanced difference information, and combining to generate the enhanced monophonic output are performed by a digital signal processor.

10. The method of Claim 1 further comprising synthetically generating the first and second inputs.

11. The method of Claim 10 wherein the act of synthetically generating the first and second inputs comprises providing a monophonic input as the first input and delaying the monophonic input to produce the second input.

12. An audio enhancement apparatus to produce a single output signal from a pair of input signals comprising:

a combiner that combines at least a portion of a first input signal with at least a portion of a second input signal to isolate a difference signal;

an enhancer operatively coupled to the difference signal, wherein the enhancer enhances spatial characteristics of the difference signal to produce an enhanced difference signal; and

a mixer that combines at least a portion of the first and second input signals with at least a portion of the enhanced difference signal to produce an output signal.

13. The apparatus of Claim 12 wherein the enhancer comprises a gain control device.

14. The apparatus of Claim 12 wherein the enhancer comprises a phase adjuster and a gain control device.

15. The apparatus of Claim 14 wherein the phase adjuster modifies a frequency response at frequencies where the frequency responses of the audio enhancement apparatus have approximately equal amplitudes and opposite phases so as to preserve audio information at the frequencies.

16. The apparatus of Claim 12 further comprising a speaker wherein parameters of the enhancer are dependent on speaker characteristics of the speaker.

17. The apparatus of Claim 12 wherein the enhancer comprises a filter and a gain control device.

18. The apparatus of Claim 12 further comprising a second combiner that combines at least a portion of the first input signal with at least a portion of the second input signal to isolate a sum signal and wherein the mixer combines at least a portion of the sum signal with at least a portion of the enhanced difference signal to produce the output signal.

19. The apparatus of Claim 18 further comprising a filter operatively coupled to the sum signal, wherein the filter adjusts the phase of the sum signal relative to the difference signal.

20. The apparatus of Claim 12 further comprising a digital signal processor wherein the digital signal processor implements the combiner, the enhancer, and the mixer.

21. The apparatus of Claim 12 further comprising a monophonic input and a stereo synthesizer wherein the stereo synthesizer synthesizes the first input signal and the second input signal from the monophonic input.

22. The apparatus of Claim 21 wherein the stereo synthesizer comprises a delay.

23. An audio enhancement apparatus to produce a single output signal from a pair of input signals comprising:

a combining means for combining at least a portion of a first input with at least a portion of the second input to produce difference information;

a enhancing means for enhancing the difference information to produce enhanced difference information; and

a mixing means for combining the enhanced difference information with at least a portion of the first and second input signals to generate an enhanced monophonic output.

24. The apparatus of Claim 23 wherein the enhancing means comprises a gain control means.

25. The apparatus of Claim 23 wherein the enhancing means comprises a phase adjusting means and a gain control means.

26. The apparatus of Claim 25 wherein the phase adjusting means modifies a frequency response at frequencies where the frequency responses of the audio enhancement apparatus have approximately equal amplitudes and opposite phases so as to preserve audio information at the frequencies.

27. The apparatus of Claim 23 further comprising a speaker wherein parameters of the enhancing means are dependent on speaker characteristics of the speaker.

28. The apparatus of Claim 23 wherein the enhancing means comprises a filtering means and a gain control means.

29. The apparatus of Claim 23 further comprising a second combining means that combines at least a portion of the first input with at least a portion of the second input to produce sum information and wherein the mixer combines at least a portion of the sum information with at least a portion of the enhanced difference information to generate the enhanced monophonic output.

30. The apparatus of Claim 29 further comprising a filtering means operatively coupled to the sum information, wherein the filtering means adjusts the phase of the sum information relative to the difference information.

31. The apparatus of Claim 23 further comprising a digital signal processor wherein the digital signal processor implements the combining means, the enhancing means, and the mixing means.

32. The apparatus of Claim 23 further comprising a monophonic input and a stereo synthesizing means wherein the stereo synthesizing means synthesizes the first input and the second input from the monophonic input.

33. The apparatus of Claim 32 wherein the stereo synthesizing means comprises a delaying means.

34. A method of generating a monophonic output from a pair of input signals comprising:

- enhancing a first input to produce enhanced first information;
- enhancing a second input to produce enhanced second information;
- inverting the enhanced second information; and

combining at least a portion of the enhanced first information with at least a portion of the inverted enhanced second information to generate an enhanced monophonic output.

35. The method of Claim 34 further comprising:

phase adjusting the first input to produce phase adjusted first information; and

phase adjusting the second input to produce phase adjusted second information, wherein the act of combining combines at least a portion of the phase adjusted first information, at least a portion of the phase adjusted second information, at least a portion of the enhanced first information, and at least a portion of the inverted enhanced second information to generate an enhanced monophonic output.

36. The method of Claim 34 wherein the act of enhancing the first input and the act of enhancing the second input comprises adjusting an amplitude of the first input and adjusting an amplitude of the second input.

37. The method of Claim 34 wherein the act of enhancing the first input and the act of enhancing the second input comprises adjusting an amplitude and phase of the first input and adjusting the amplitude and phase of the second input.

38. The method of Claim 37 wherein adjusting the phase modifies a frequency response at frequencies where the frequency responses of an audio enhancement system have approximately equal amplitudes and opposite phases so as to preserve audio information at the frequencies.

39. The method of Claim 34 further comprising reproducing audio from the enhanced monophonic output through a speaker wherein the acts of enhancing are dependent on speaker characteristics of the speaker.

40. The method of Claim 34 wherein the acts of enhancing the first input and the second input comprise filtering and adjusting the gain of the first input and the second input.

41. The method of Claim 34 wherein the acts of enhancing to produce enhanced first information, enhancing produce enhanced second information,

inverting the enhanced second information, and combining to generate the enhanced monophonic output are performed by a digital signal processor.

42. The method of Claim 34 further comprising synthetically generating the first and second inputs.

43. The method of Claim 42 wherein the act of synthetically generating the first and second inputs comprises providing a monophonic input as the first input and delaying the monophonic input to produce the second input.

44. An audio enhancement apparatus to produce a single output signal from a pair of input signals comprising:

a first enhancer operatively coupled to a first input to produce enhanced first information;

a second enhancer operatively coupled to a second input to produce enhanced second information;

an inverter to invert the enhanced second information; and

a mixer that combines at least a portion of the enhanced first information with at least a portion of the inverted enhanced second information to generate an enhanced monophonic output.

45. The apparatus of Claim 44 further comprising:

a first phase adjuster that adjusts a phase of the first input to produce phase adjusted first information; and

a second phase adjuster that adjusts the phase of the second input to produce phase adjusted second information, wherein the mixer combines at least a portion of the phase adjusted first information, at least a portion of the phase adjusted second information, at least a portion of the enhanced first information, and at least a portion of the inverted enhanced second information to generate an enhanced monophonic output.

46. The apparatus of Claim 44 wherein the first enhancer comprises a first gain control device and the second enhancer comprises a second gain control device.

47. The apparatus of Claim 34 wherein the first enhancer comprises a first phase adjuster and a first gain control device and the second enhancer comprises a second phase adjuster and a second gain control device.

48. The apparatus of Claim 47 wherein the phase adjuster modifies a frequency response at frequencies where the frequency responses of the audio enhancement apparatus have approximately equal amplitudes and opposite phases so as to preserve audio information at the frequencies.

49. The apparatus of Claim 44 further comprising a speaker wherein parameters of the first and second enhancers are dependent on speaker characteristics of the speaker.

50. The apparatus of Claim 44 wherein the first enhancer comprises a first filter and a first gain control device and the second enhancer comprises a second filter and a second gain control device.

51. The apparatus of Claim 44 further comprising a digital signal processor wherein the digital signal processor implements the first enhancer, the second enhancer, and the mixer.

52. The apparatus of Claim 44 further comprising a monophonic input and a stereo synthesizer wherein the stereo synthesizer synthesizes the first input and the second input from the monophonic input.

53. The apparatus of Claim 52 wherein the stereo synthesizer comprises a delay.